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ESTIMATE OF THE INDUSTRIAL CAPABILITY OF THE USSR TO PRODUCE SUBMARINES UNDER AN INDUSTRIAL MOBILIZATION PROGRAM

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INTRODUCTION

The purpose of this paper is to estimate the industrial capability of the USSR to produce submarines under an all out industrial mobilization program calling for the production of all implements of war. The effect of attacks by the US or Allied armed forces on Soviet production, in the event of war, have not been considered in this estimate.

Mobilization of the shipbuilding industry for expansion of submarine construction is considered in three separate phases.

The first period (Phase A) considers optimum utilization of specialized facilities currently used for submarine production.

The second period (Phase B) considers for submarine construction the use of certain additional building ways and sites not used since World War II for the construction of major naval surface vessels.

Finally, generalized consideration is given (Phase C) to additional methods of expanding submarine output.

Special attention is given to the time interval between M-day (mobilization day) and the achievement of the probable optimum rate of output.

The supply of the two major components - steel and diesel engines and the required increase in shipyard labor is also discussed.

I. Estimate of the Soviet [redacted] Under Three Phases of Industrial Mobilization.

Because of the probable high priority that will be assigned to submarine production, it is assumed that allocation of resources will be adequate for the several phases and that no delays will be encountered. The time interval between M-day and the achievement of the probable peak (optimum) production is estimated on the basis of US analogy modified by the knowledge of Soviet achievements in the industrial field since World War II.

All estimates of Soviet production capability are for one type of submarine - the "W"-Class.* It is recognized that other types of submarines, having different characteristics that may vary building time, may be constructed during the period, but no attempt is made to estimate either the type or rate of output.

The estimated production of submarines under the three phases of industrial mobilization is shown graphically in Figure 1.** An analysis of each of those phases is contained in the following pages.

A. Phase A - Optimum Annual Rate of Output From Facilities Currently Engaged in the Production of Submarines.

It is assumed that the first phase in mobilization will be to raise the annual output from the special construction facilities currently engaged in the production of submarines. The current annual output (1956) from these facilities is about 70 "W"-Class and 25 "Q"-Class. An equivalent for average yearly production in terms of "W"-Class is about 90 and it is estimated that this rate can be raised to 156.

The facilities currently engaged in the production of submarines and the estimated annual rate of output of "W"-Class employing 3 labor shifts,*** is shown in Table 1.****

* The "W"-Class submarine is the leading Soviet long range submarine with respect to numbers built. Over 200 have been constructed since 1951. This Class has diesel and electric propulsions and conventional armament and has a standard displacement of about 1,050 tons and a light ship weight of about 880 tons.

** Figure 1 follows page 2.

*** See page for manpower analysis.

**** Table 1 appears on page 3.

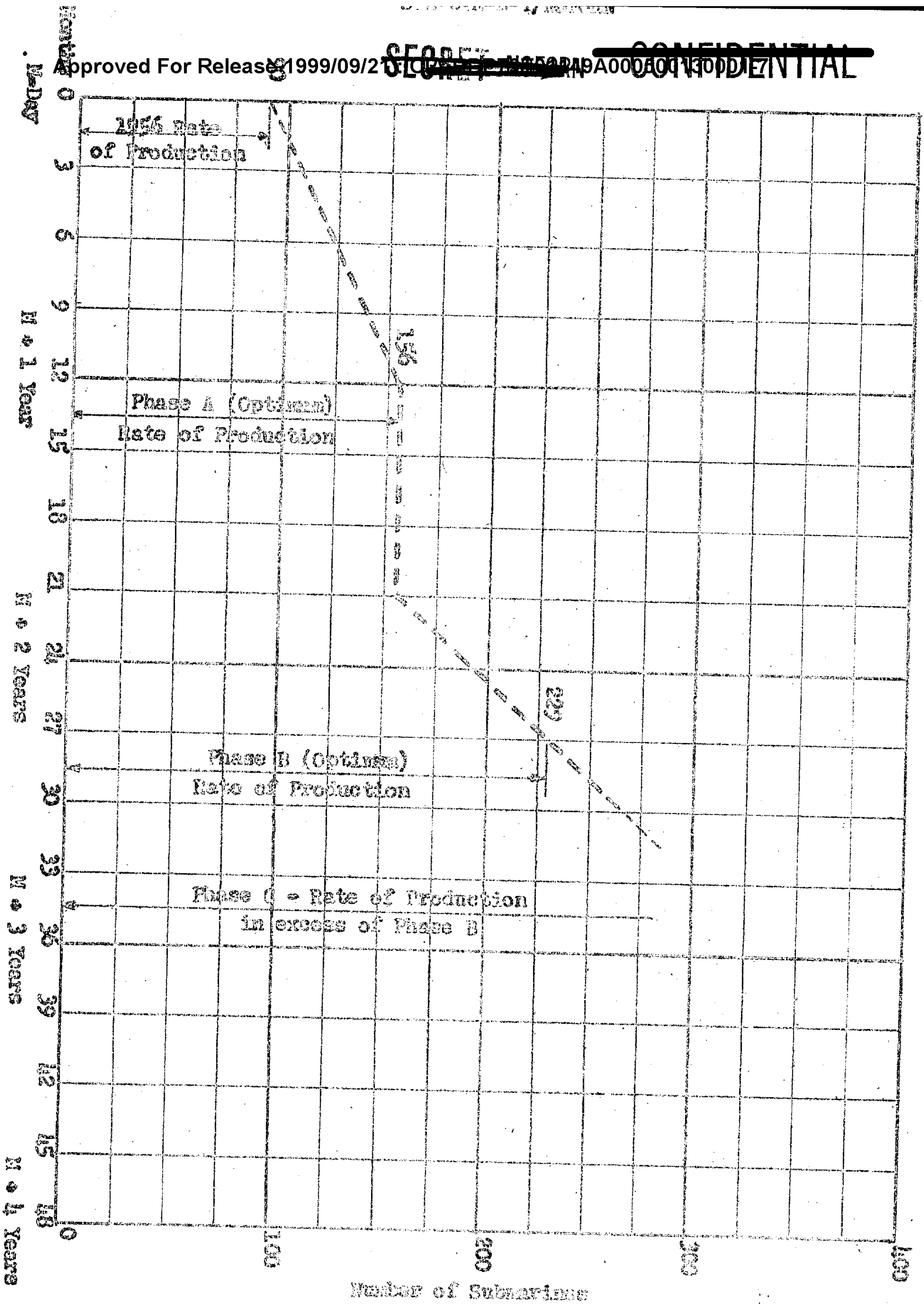

FIGURE 1

USSR: ESTIMATED PRODUCTION OF SUBMARINES
UNDER 3 PHASES OF INDUSTRIAL MOBILIZATION

Table 1

Phase A

Special Facilities Currently Engaged in the Construction of Submarines and Estimated Optimum Annual Rate of Output

Location	Shipyard	Number of Berths, (Ways, Sites & Docks)	Annual Rate of Output Per Berth a/	Annual Rate of Output a/
Leningrad	Baltic #189	4	4 c/	16
	Krylov #194 b/	4	4 c/	16
	Sudomekh #196	6	4 c/	24
Gorkiy	Krasnoye Sormovo #112	13	4.5	58
Nikolayev	Nosenko #444	4	4.5	18
Komsomolsk	Komsomolsk #199	8	3	24
		39		156

a. 12 months after M-day.

b. No submarines have been reported from this facility, however, it is considered to be part of Phase A estimate.

c. Because of the cooperation among the shipyards in the Leningrad area in the production of submarine components, an overall average annual output of 4 per way or site was assigned.

The facilities listed in Table 1 are specially suited for the assembly of ships by using sectional method of construction, i.e. the joining together on the building ways, on the building sites, and in the building docks of assembled hull sections which are prefabricated in shops in the yard or adjacent plants. In the Nosenko Shipyard in Nikolayev the method of assembly closely follows assembly line technique. Production in the Krasnoye Sormovo Shipyard, the leading submarine production yard in the USSR, was at the rate of 1 submarine per berth (site) every 2½ months in 1952 when the yard had only 3 berths for submarine construction. This production rate was not maintained when the additional 10 berths were completed, but it does indicate a capability of the shipyard and a rate of production by sectional construction method. Because of the high priority assigned to submarine construction

in 1952, it is thought that the rate of 1 submarine per berth every 2½ months represents a maximum rate by trained labor and carefully scheduled construction sequence. It is possible that Soviet engineers and planners were engaged in a production rate exercise to test the feasibility of this method. Under national mobilization the skilled labor force would be relatively decreased and made up of semi-qualified labor thereby reducing the overall annual rate of output.

Other shipyards listed in Table 1 engaged in submarine production during the past several years but never attained the rate of output achieved by Krasnoye Sormovo Shipyard with the possible exception of the Nosenko Shipyard. The estimated optimum annual rate of output from these yards, shown in Table 1, is based on the shipyards' record of production and available data on facilities and supporting shops.

A yearly output amounting to an equivalent of 156 "W"-Class submarines from 39 building berths averages 3 months per submarine per berth or an average output of 4 "W"-Class submarines per berth per year. It should be noted that submarines are approximately 90-95 percent complete when launched from these facilities.

The sectional assembly method of constructing submarines cannot be compared with US methods because this technique is not employed in the US. By contrast, it can be pointed out that two leading US submarine builders, the Electric Boat Company and the Portsmouth Naval Yard, under US mobilization plans, indicate after the construction of the 16th vessel a construction schedule of approximately 9 months, (4½ months on the building way and 4½ months fitting out) not including 1 month lead time, to produce a slightly larger submarine of approximately 1,600 standard displacement tons.

B. Phase B - Optimum Annual Rate of Output From the Special Submarine Construction Facilities and Readily Available Additional Facilities. (Phase B Includes Phase A).

It is assumed that the second phase in mobilization will be to raise the annual output by adding certain facilities which have not been used since World War II for the construction of major naval surface vessels but could easily be made suitable for submarine construction.

The estimated annual output of "W"-Class submarines employing 3 labor shifts* from these facilities and including total of Phase A, is shown in Table 2.**

* See page 7 for manpower analysis.

** Table 2 appears on Page 5.

Table 2

Phase B

Theoretical Allocation of Additional Facilities

to Submarine Construction and Estimated Optimum Annual Rate of Output

Location	Shipyard	Number of Berths (Ways & Sites)	Optimum Annual Rate of Output Per Berth a/	Optimum Annual Rate of Output a/
Leningrad	Baltic	2	2.5 b/	5
	Zhdanov #190	4	2.5 b/	10
	Kronshtadt	6	2.5 b/	15
Nikolayev	Nosenko #444	5	2.5 b/	13
Sevastopol	Sevastopol #497	2	2.5 b/	5
Molotovsk	Molotovsk #402	10	2.0 c/	20
	Molotovsk #402	2	2.5 b/	5
		31		73
			Phase A d/	156
			Grand Total Phase B	229

a. Optimum annual rate obtained 27 months after M-day. First vessel completed 21 months after M-day.

b. Based on approximately 5 months on the building berth and 5 months fitting-out. Inasmuch as fitting out is not done on the building berth but at a fitting-out quay, the annual production rate is based on time on the building berth only.

c. Based on 6 months on the building berth.

d. From Table 1.

As none of these facilities have been used for submarine construction after World War II, the estimated rate of output is based first, on the assumption that these facilities will be improved to a level equal to similar facilities currently engaged in destroyer production; second, on Soviet capability for naval construction and third, on the use of construction technology analogous with US submarine building yards.

US mobilization plans for experienced submarine building yards schedule delivery of the first submarine 18 months after M-day and near-maximum production 24 months after M-day. The schedule at near-maximum production is approximately 4½ months on the building way and 4½ months fitting-out.

Two of the yards listed in Table 2, the Baltic and the Nosenko shipyards, are already engaged in submarine construction and should reach optimum annual rate of production on the additional facilities in relatively short time.

The Zhdanov Shipyard has built submarine sections since World War II and should have little difficulty in reaching optimum production rate within 27 months.

Kronshtadt, Sevastopol, and Molotovsk shipyards may need slightly more time to reach optimum production depending on the availability of necessary skilled personnel.

Molotovsk Shipyard is also handicapped by more difficult working conditions on the open air ways because of the lack of adequate weight handling facilities and because of severe winter weather conditions. Ten of the ways at Molotovsk, therefore, are estimated to require about 50 percent more way time than for the other yards. Two of the open air ways at Molotovsk are served by an assembly shop and is considered able to follow the average production rate.

C. Phase C - Discussion of Additional Methods for Expanding Submarine Production.

Assuming that no greater utilization of existing shipbuilding facilities is possible, than contemplated under Phases A and B, then any additional submarine production must come from industrial expansion.

Additional production may be accomplished by expanding assembly shops and building ways in existing shipyards; by converting certain industrial machine and metal working shops to the assembly of submarine hull and machinery components into large submarine subsections for shipment to newly built assembly shipyards, either in the USSR or possibly in the satellite countries; and by building new component producing plants.

The extent of conversion and expansion under Phase C cannot be estimated because undoubtedly it will be determined on the basis of Soviet objectives and on maintaining balance in the allocation of resources to other military sectors and consumer goods.

II. Steel, Diesel and Manpower Availability.

Overall industrial capability to support expanded submarine production is believed to be adequate. An examination of steel and diesel engine production and manpower availability produce little evidence of the likelihood of shortages in these major areas.

The optimum production of submarines under Phase B possibly will require about 100,000 tons of high tensile steel annually for pressure hull construction. The USSR has ample open hearth and electric furnace production capacity to produce many times the required special quality ingot steel and in addition it has adequate plate mill capacity to roll the necessary plates.

The diesel engine manufacturing capability of the USSR industry has been expanded to meet requirements for the dieselization of railroads. Currently, submarine diesels are produced by the Kolomna Locomotive Plant and similar 2000 h.p. diesels for railroad locomotives are produced by the Khar'kov Transport Maritime Building Plant. Under the railroad dieselization program approximately 8,000 to 10,000 locomotive diesels are scheduled for production from these and other plants during the Sixth Five-Year plan. It becomes apparent that under an industrial mobilization program, with a reduction in the allocation of diesels to railroads, this industry easily could support a submarine program of 400 to 500 boats.

No exhaustive study has been made of the potential supply of other components, however, viewed in light of the industrial progress made in the USSR since World War II it is thought that an annual component output somewhat in excess of the total required under Phase B is possible.

It is estimated that 36,000 people are currently employed in productive or direct shipyard labor to produce submarines. Under Phase A this figure will rise to 63,000 and under Phase B to 91,000. Expansion through Phase B will require about a 200 percent increase, however, in terms of absolute figures this increase is not large.

The estimate of required manpower is based on the following formula:

$$\frac{A \cdot B}{C} = M$$

A = Total standard displacement tons (SDT) produced in one year.

B = Manhours required to produce one (1) SDT.

= 884 (US analogy)

C = Manhours in one Soviet manyear.

= 2224. (365 - 87 - 8 = 2224. 87 days = 52 Sundays, 12 days vacation, 16 days absenteeism and 7 national holidays.)

Therefore:

$$\text{Current employment} = \frac{90{,}000 \circ 884}{2224} = 36{,}000$$

$$\text{Phase A employment} = \frac{156{,}000 \circ 884}{2224} = 63{,}000$$

$$\text{Phase B employment} = \frac{229{,}000 \circ 884}{2224} = 91{,}000$$

No great difficulty is anticipated in recruiting the additional labor force from lower priority shipbuilding and repair activities and from some consumer goods industries.

It is assumed that under industrial mobilization 3 labor shifts will be used in submarine construction and that the percentage of total direct labor employed in each shift probably will be in the same order as indicated in US mobilization plans -

First Shift - 60 percent

Second Shift = 30 percent

Third Shift = 10 percent

These percentages may vary in the case of mass production yards where the highest efficiency is obtained by more or less continuous operation of automatic and semi-automatic machinery in the prefabrication shops.

Because of the use of automatic and semi-automatic machinery in the sectional construction of submarines, a greater percentage of lower skilled labor can be employed than formerly when similar work was done manually.